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Original Contribution

National ED crowding and hospital quality: results from 2013 Hospital Compare data

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ABSTRACT

Objectives: We explored Hospital Compare data on emergency department (ED) crowding metrics to assess characteristics of reporting vs nonreporting hospitals, whether hospitals ranked as the US News Best Hospitals (2012-2013) vs unranked hospitals differed in ED performance and relationships between ED crowding and other reported hospital quality measures.

Methods: An ecological study was conducted using data from Hospital Compare data sets released March 2013 and from a popular press publication, US News Best Hospitals 2012 to 2013. We compared hospitals on 5 ED crowding measures: left-without-being-seen rates, waiting times, boarding times, and length of stay for admitted and discharged patients.

Results: Of 4810 hospitals included in the Hospital Compare sample, 2990 (62.2%) reported all ED 5 crowding measures. Median ED length of stay for admitted patients was 262 minutes (interquartile range [IQR], 215-326), median boarding was 88 minutes (IQR, 60-128), median ED length of stay for discharged patients was 139 minutes (IQR, 114-168), and median waiting time was 30 minutes (IQR, 20-44). Hospitals ranked as US News Best Hospitals 2012 to 2013 (n = 650) reported poorer performance on ED crowding measures than unranked hospitals (n = 4160) across all measures. Emergency department boarding times were associated with readmission rates for acute myocardial infarction ($r = 0.14$, $P < .001$) and pneumonia ($r = 0.17$, $P < .001$) as well as central line–associated bloodstream infections ($r = 0.37$, $P < .001$).

Conclusions: There is great variation in measures of ED crowding across the United States. Emergency department crowding was related to several measures of in-patient quality, which suggests that ED crowding should be a hospital-wide priority for quality improvement efforts.

1. Introduction

Emergency department (ED) crowding is a common issue in many hospitals in the United States and around the world [1]. Nationally, the number of ED visits is increasing faster than population growth, whereas patients presenting to EDs receive more resource intensive care than in previous years [2,3]. Increased ED use has negative effects on a variety of ED processes and patient-oriented outcomes. Emergency department crowding is associated with poorer pain care [4], delayed antibiotics in pneumonia [5,6], increased in-hospital mortality [7,8], and an increased likelihood of patients leaving without being seen [9-11].

Recently, there has been an increased focus on quality measurement and improvement in US hospitals. Organizations including governmental agencies, such as the Center for Medicare and Medicaid Services (CMS) and nongovernmental entities, such as the National Quality Forum, have supported quality measures, including several measures of ED crowding, with the goal of improving care. Measurement data are made publicly available on a Department of Health and Human Services (HHS) website called Hospital Compare (www.medicare.gov/hospitalcompare/) and includes data from a variety of sources, including patient-completed surveys, readmission, complication, and mortality rates in hospitals and both timeliness and effectiveness measures. In March 2013, Hospital Compare publicly released ED crowding data for thousands of hospitals for the first time in the United States in the form of several measures: left-without-being-seen rates, separate measures of ED length of stay for discharged and admitted patients, and ED boarding times and waiting times.

In this study, we explored Hospital Compare data related to ED crowding measures in US hospitals in a variety of ways. First, we assessed whether there were measurable hospital factors associated with hospitals that reported the measures. Second, we investigated whether an assessment of hospital quality in the popular press (US News Best Hospitals 2012-2013) was associated with differences in ED crowding. Finally, we explored the relationship among crowding measures and the relationship between ED crowding measures and other quality metrics, specifically process and outcome measures.

2. Methods

2.1. Study design and setting

We conducted an ecological study using data from the downloadable Hospital Compare data files found on the Medicare Hospital Compare

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website. Our goal was to explore data from the hospital-level ED crowding measures: median time from ED arrival to ED departure for admitted ED, admit decision time to ED departure time for admitted patients, median time from ED arrival to ED departure for discharged ED patients, time from door to diagnostic evaluation by a qualified medical professional, and percentage of patients who left the ED before being seen. Each hospital reported a single value for each measure. The public website was accessed in March 2013, soon after the crowding measures were released. We linked the Hospital Compare data to the US News Best Hospitals 2012 to 2013 publication to identify 650 top-ranked hospitals regionally [12].

We also included other data from Hospital Compare, including measures of care quality, data on readmissions, complications, and deaths, patient experience, and spending per Medicare beneficiary. Hospital Compare data are derived primarily from Medicare enrollment and claims data; however, we also analyzed data from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) surveys. In addition, we analyzed measures on serious complications and deaths compiled by the Agency for Healthcare Research and Quality (AHRQ). The downloaded data file represented data collected over nonconcurrent reporting periods from 2008 to 2012. Emergency department crowding measures were collected between January 1, 2012, and June 30, 2012, whereas patient survey results and timely and effective care data were collected between July 1, 2011, and June 30, 2012. Readmission and mortality outcomes were collected between July 1, 2008, and June 30, 2011, whereas hospital-acquired infections and other complications data were collected between July 1, 2009, and June 30, 2011. Imaging data were collected for calendar year 2010, whereas Medicare spending data were collected between May 1, 2011, and December 31, 2011.

In addition to the Hospital Compare data files, we used listings from US News Best Hospitals 2012 to 2013, published July 2012, to identify "top-ranked hospitals" regionally. We coded hospitals according to whether they were regionally ranked by US News. US News uses a proprietary methodology for hospital rating that includes hospital reputation (as assessed by random polling of 200 physicians in each ranked specialty), in-patient mortality rates, patient safety data, and other care indicators. US News ratings used mortality data collected between 2008 and 2010, whereas physician reputation surveys were collected and averaged between 2010 and 2012. Further detail on ranking methodology can be found at the US News website [13].

Hospital Compare data files and the US News and World Report data are publicly accessible and contain no patient-identifiable information. As such, this study was not considered "human subjects" research by The George Washington University.

2.2. Data processing

To facilitate analysis, we first combined separate data files downloaded as part of the Hospital Compare database. Data were linked using hospital identification numbers provided in each file.

Hospital characteristics in the public data file included the state or territory in which the hospital is located, hospital ownership, and hospital type. To facilitate comparison, we grouped states into 10 regions as defined by the US Department of HHS. Examples of hospital ownership type as reported in the data file included governmental, physician owned, tribal, proprietary, and voluntary nonprofit. We grouped hospitals into 3 ownership categories: proprietary, governmental, and voluntary nonprofit. Hospital types included acute care hospitals, children's hospitals, critical access hospitals, and acute care veterans' hospitals. To assess possible effects of educating medical students and residents on ED crowding, we coded hospitals according to whether they are listed as teaching hospitals in CMS data files. Finally, we also coded hospitals according to whether they appeared in the US News Best Hospitals 2012 to 2013 list [12].

To examine relationships between care quality and ED crowding at the hospital level, we chose variables associated with either in-patient or outpatient hospital use, where patients could plausibly be seen in the ED. These measures included 30-day mortality and readmissions rates, acute myocardial infarction (AMI), HCAHPS data, health care–associated infections, hospital-acquired conditions (HAC), Medicare spending, outpatient imaging efficiency, pneumonia, and serious complications and deaths. Although many of these measures are more general than ED crowding and certainly involve many patients who were not seen in the ED, we chose to be inclusive as this study was intended to be exploratory.

2.3. Data analysis

We first calculated the number of hospitals missing data for each of the 5 ED crowding measures. We then tabulated the top and bottom 50 hospitals in overall ED length of stay (see Appendix). To analyze national ED crowding, we computed medians and interquartile ranges (IQRs) for each ED crowding measure in the Hospital Compare data set. We then calculated the number of hospitals that reported each ED crowding measure. We performed cross tabulations of hospitals reporting by hospital type, ownership, HHS region, whether the hospital was listed as a US News Best Hospital 2012 to 2013, and whether the hospital was designated as a teaching hospital. We also divided hospitals into quartiles based on hospital size. We assessed for statistically significant differences in reporting using χ^2 tests. For all analyses, $P < .05$ was considered statistically significant.

To assess the relationship between ED crowding and US News Best Hospital 2012 to 2013 rating, we compared ranked hospitals with unranked hospitals. To examine potential associations between being a teaching hospital and ED crowding, we also compared teaching hospitals with nonteaching hospitals. Because of the non-normal distribution of data in the ED crowding measures, we used Mann-Whitney *U* tests to compare medians across categories.

To examine the relationship between ED crowding measures, we calculated Spearman rank correlation coefficients, again due to non-normal distributions in the data. We also calculated Spearman correlations between ED crowding measures and other hospital quality measures. We used Cohen's guidelines to interpret effect size in correlations, with correlations with absolute value greater than 0.1 considered small, greater than 0.3 considered medium, and greater than 0.5 considered large [14].

As this study was exploratory in nature, we elected to analyze and report on all variables for which Hospital Compare data were available. Variables were selected for analysis a priori based on their potential relevance to the ED setting. All data were compiled using Stata, version 12 (StataCorp, College Park, TX).

3. Results

3.1. Average US ED crowding levels

The national median for "median time from ED arrival to ED departure for admitted ED patients" was 262 minutes (IQR, 215-326), whereas the national median for the time between decision to admit and ED departure time for admitted patients was 88 minutes (IQR, 60-128). For discharged patients, the national median time between arrival and discharge was 139 minutes (IQR, 114-168). The national median time between ED arrival and diagnostic evaluation by a qualified medical professional was 30 minutes (IQR, 20-44). Nationally, the average percentage of patients who left before being seen was 1.9%.

3.2. Reporting vs nonreporting hospitals

In 4810 hospitals, reporting varied by measure and ranged from a high of 3518 (73.1%) for "percentage of patients who left before being

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seen" to a low of 3145 (65.4%) for "door to diagnostic evaluation by a qualified medical professional time." Overall, 1820 (37.8%) hospitals did not report at least 1 of the 5 ED crowding measures, whereas 2990 (62.2%) reported all ED crowding measures.

There was significant variation between hospital types in the proportion of hospitals reporting all 5 ED crowding measures. Across hospital types, acute care hospitals were the most likely to report all 5 measures, with 84.5% reporting. Among hospitals designated as critical access, 5.8% reported all 5 measures, whereas 0.8% of acute care Veterans Health Administration hospitals and no children's hospitals reported all crowding measures ($P < .001$). Government-owned hospitals were less likely to report all measures (44.6%) than proprietary (71.9%) or voluntary nonprofit hospitals (67.0%) ($P < .001$).

Reporting rates varied significantly by HHS region as well. For example, in the Denver region, only 35.0% of hospitals reported all crowding measures, whereas 77.5% of hospitals in the Atlanta region reported all crowding measures. There was a significant difference in reporting rates across groups ($P < .001$).

3.3. US News Best Hospitals

The 650 hospitals designated as US News Best Hospitals 2012 to 2013 were more likely to report all 5 crowding measures than the 4160 hospitals without the designation, 87.7% vs 58.2% ($P < .001$). Teaching hospitals were more likely than nonteaching hospitals to report all measures, 87.2% vs 55.2% ($P < .001$) Hospital size was associated with reporting, as hospitals in the lowest quartile of bed capacity were less likely to report all measures (8.1%) than hospitals in the larger 3 quartiles (84.0%, 90.2%, and 89.8%; $P < .001$) (Table 1).

There were significant differences in ED crowding between hospitals ranked by US News Best Hospitals 2012 to 2013 and unranked hospitals. Top-ranked hospitals had longer median arrival to departure times for admitted patients by about an hour (267.2 minutes vs 328.5 minutes; $P < .001$), longer waits between decisions to admit and ED departure for admitted patients (132.6 minutes vs 96 minutes; $P < .001$), and longer lengths of stay for discharged patients (174.5 minutes vs 141 minutes; $P < .001$). In addition, top-ranked hospitals had longer waiting times to be seen by a qualified medical professional (42.3 minutes vs 35.8 minutes; $P < .001$) as well as a greater percentage of patients leaving before being seen (2.3% vs 1.8%; $P < .001$) (Table 2).

3.4. Teaching hospitals

In general, teaching hospitals reported greater levels of ED crowding than did nonteaching hospitals. Teaching hospitals reported longer median arrival to departure times (330.5 minutes vs 257.2 minutes, $P < .001$), longer waits between decision to admit and ED departure for admitted patients (131.9 minutes vs 90.7 minutes, $P < .001$), and longer lengths of stay for discharged patients (169.0 minutes vs 138.2 minutes, $P < .001$). Teaching hospitals also reported longer waits to be seen by a medical professional (42.7 minutes vs 34.7 minutes, $P < .001$) and a greater percentage of patients who left before being seen (2.4% vs 1.7%, $P < .001$).

3.5. ED crowding and hospital quality measures

In general, worse performance on ED crowding measures was associated with lower mortality rates and lower patient satisfaction. For example, higher median times from ED arrival to ED departure for admitted patients were associated with lower 30-day mortality from heart failure ($r = -0.20$, $P < .001$). Higher time from arrival to departure for admitted patients was associated lower rankings on patient satisfaction, including the percentage of patients who reported their doctors "always" communicated well ($r = -0.43$, $P < .001$), the percentage of patients who reported their pain was "always" well controlled ($r = -0.26$, $P < .001$), and the percentage of patients who rated the hospital as 9 or 10 of 10 ($r = -0.23$, $P < .001$). Other crowding measures demonstrated similar findings. The percentage of patients who reported they would definitely recommend the hospital was not associated with any of the crowding measures, with the exception of the percentage of patients who left without being seen ($r = -0.14$, $P < .001$).

Poorer performance on ED crowding measures was positively associated with higher readmission rates. For example, median time from arrival to departure for admitted patients was associated with 30-day readmission rates for AMI ($r = 0.14$, $P < .001$), heart failure ($r = 0.14$, $P < .001$), and pneumonia ($r = 0.17$, $P < .001$). Times from

Table 1
Characteristics of hospitals reporting all ED crowding measures

	Hospitals reporting all measures	Hospitals not reporting all measures	Percent reporting	*P*
Hospital type				
Acute care hospital	2919	537	84.5%	.001
Children's hospital	0	22	0.0%	
Critical access hospital	70	1136	5.8%	
Acute care veterans	1	125	0.8%	
Hospital ownership				
Proprietary	590	231	71.9%	.001
Government	545	677	44.6%	
Voluntary, nonprofit	1855	912	67.0%	
Department of HHS region				
1 - Boston	136	56	70.8%	.001
2- New York	216	87	71.3%	
3- Philadelphia	250	126	66.5%	
4 - Atlanta	701	204	77.5%	
5 - Chicago	531	345	60.6%	
6 - Dallas	472	267	63.9%	
7 - Kansas City	172	263	39.5%	
8 - Denver	104	193	35.0%	
9 - San Francisco	314	167	65.3%	
10 - Seattle	94	112	45.6%	
US News Best Hospitals 2012-2013 ranked hospitals				
Ranked	570	80	87.7%	.001
Unranked	2420	1740	58.2%	
Teaching hospitals				
Teaching hospital	911	134	87.2%	.001
Nonteaching hospital	2079	1686	55.2%	
Hospital size				
First quartile (1-25 beds)	110	1241	8.1%	.001
Second quartile (26-88 beds)	771	147	84.0%	
Third quartile (89-202 beds)	1007	109	90.2%	
Fourth quartile (203-2068 beds)	1014	115	89.8%	

Table 2
Median values for ED crowding measures for US News Best Hospitals 2012 to 2013 and unranked hospitals

	US News Best Hospitals 2012-2013	Hospitals not ranked by US News Best Hospitals 2012-2013	Difference (95% CI)	*P*
Median time from ED arrival to ED departure for admitted ED patients	315	251	64 (54-68)	.001
Admit decision time to ED departure time for admitted patients	117	80	37 (32-40)	.001
Median time from ED arrival to ED departure for discharged ED patients	167	132	35 (31-39)	.001
Door to diagnostic evaluation by a qualified medical professional	37	28	9 (6-10)	.001
Percentage of patients who left the ED before being seen	2	1	1	.001

Abbreviation: *CI*, confidence interval.

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decision to admit to ED departure time were also associated with readmission rates.

Lower performance on ED crowding measures was also associated with higher rates of hospital-acquired infections. Median time from arrival to departure for admitted patients was positively associated with catheter-acquired urinary tract infections per 1000 discharges (CAUTIs; $r = 0.18$, $P < .001$) and central line–associated bloodstream infections per 1000 discharges (CLABSIs; $r = 0.37$, $P < .001$). Crowding measures for discharged patients were similarly associated with HAC. Median time from arrival to departure for discharged patients was positively associated with CAUTIs per 1000 discharges ($r = 0.21$, $P < .001$) and CLABSIs per 1000 discharges ($r = 0.35$, $P < .001$). Times from arrival to diagnostic evaluation were also associated with CAUTIs ($r = 0.10$, $P < .001$) and CLABSIs ($r = 0.19$, $P < .001$).

Spending per Medicare beneficiary was also associated with ED crowding with higher crowding having been associated with higher spending: with median time from arrival to departure for admitted patients ($r = 0.22$, $P < .001$), time from decision to admit to ED departure ($r = 0.24$, $P < .001$), and time from arrival to departure for discharged patients ($r = 0.17$, $P < .001$) (Table 3).

4. Discussion

From these data, we confirm that ED crowding is a common national phenomenon in US hospitals, with the average US patient spending more than 4 hours in the ED before being transferred to an in-patient bed. However, crowding varies to a large degree between hospitals, where some EDs are more efficient with shorter lengths of stay and lower left-without-being-seen rates. These data are also similar to data reported in other national surveys, such as the National Hospital Ambulatory Care Survey, which reported a median time from arrival to diagnostic evaluation of 33 minutes, similar to our reported data of 30 minutes [14]. Ours, however, is the first study is to examine the association between a popular assessment of quality (US News Best Hospitals) and its links with ED crowding. Hospitals ranked by US News Best Hospitals had performance worse than nonranked hospitals on ED crowding metrics. This may be partially a function of hospital size and number of ED visits, which have higher crowding levels, after adjusting for other factors [16]. These hospitals may experience greater demand due to perceptions of better quality of care; however, that the nation's "best hospitals" on average keep their patients waiting for longer periods in the ED is an important message that these hospitals in particular should focus efforts on enhancing ED flow.

This study also found differences in reporting rates across several categories. Critical access hospitals were substantially less likely to report all ED crowding measure than were hospitals classified as "acute care" hospitals. Critical access hospitals are typically rural, community-based hospitals that may have fewer resources and less likely to have developed infrastructure, such as electronic health records, that facilitate reporting. This was also reflected in lower reporting rates in small hospitals. Proprietary hospitals were more likely to report all measures than either government-owned or nonprofit hospitals. Proprietary hospitals may be interested in competing for market share based, in part, on publicly reported hospital quality. There was a wide range in reporting rates across HHS regions, with generally higher rates in the Northeast United States, which tends to be more densely populated and where hospital competition may be higher. Alternatively, hospitals in the Northeast may have a greater focus on quality improvement. Hospitals ranked by US News Best Hospitals reported at a greater rate than unranked hospitals, which may reflect similar interests among these hospitals. In addition, teaching hospitals were significantly more likely to report all measures than were nonteaching hospitals as well as greater average crowding measures. Many teaching hospitals were also ranked as US News Best Hospitals.

Thirty-day mortality rates were negatively associated with crowding measures, indicating that as crowding increased, mortality was lower. This finding is different than studies demonstrating the opposite relationship, which may reflect that the unadjusted results may be confounded by other factors [8]. However, it is also possible that these findings may be mediated by overall hospital quality, as better hospitals may have greater demand in their EDs. Crowding was also positively correlated with higher readmission rates, which may also be confounded given the results are unadjusted but also may indicate that hospitals with more crowded EDs have more difficulty coordinating outpatient follow-up care for discharged patients.

Overall, there was lower reported patient satisfaction in hospitals with higher rates of ED crowding. These findings support previous single-center studies, which found that prolonged boarding and treatment times were associated with lower overall satisfaction with subsequent hospitalization [17,18]. This finding could suggest that crowded EDs may have spillover effects in negative patient satisfaction ratings at the in-patient level. Alternatively, a common factor (for instance, hospital size) may underlie both variables. Future research in health care administration could examine the effects of ED crowding improvement on in-patient satisfaction reports.

Health care–associated infections were positively correlated with ED crowding, suggesting that longer ED dwelling times may increase the risk of certain complications. This could be a result of patients being housed in closer quarters in the ED for longer periods of time. In part, these findings may also explain the association between ED crowding and Medicare spending. Quality measures for the treatment of pneumonia in the ED, including blood cultures performed before initial antibiotic and the time to administration of an appropriate antibiotic, were not related to ED crowding measures. This finding is different from previous studies on the topic [5,19] and may reflect interventions on the part of hospitals to address these measures, which have been the focus of quality improvement efforts for a longer time.

5. Limitations

This study has several important limitations. As an exploratory ecological study, concluding any causal relationships between variables is not possible. In addition, because the associations did not adjust for other factors, there is a reasonable likelihood that many of the results may be confounded. In addition, the measures we investigated were influenced by significant reporting bias, with smaller rural hospitals potentially underrepresented. Furthermore, many of these measures were not reported concurrently and reflected a 4-year period (2008-2012). Although hospitals tend to perform similarly over time with respect to many quality measures, measures tend to improve the longer a measure is reported.

An important consideration when examining reported quality measures is the potential for information bias. The accuracy of the reported measures is unknown, although there is reason to believe at least some hospitals reported skewed results [20]. It is unknown whether these information biases were systematic. Furthermore, the data reported to Hospital Compare are drawn from samples within hospitals rather than a hospital's entire population. These samples may be subject to biases of their own, thereby injecting uncertainty into attempts to generalize from these data [21].

Beyond the ED crowding measures, there was considerably more variation in reporting of in-patient hospital quality measures. Some measures had missing data for more than 90% of hospitals in the United States. Low reporting among these measures may skew results toward hospitals with better outcomes.

It was not possible to investigate all potential hospital-level factors that may be correlated with ED crowding. For instance, publicly owned hospitals may have experienced greater ED crowding than privately owned hospitals due to their patient populations, lesser

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Table 3
Correlations between ED crowding measures and other hospital quality measures

Category	Description	No. reporting	Median time from ED arrival to ED departure for admitted ED patients	Admit decision time to ED departure time for admitted patients	Median time from ED arrival to ED departure for discharged ED patients	Door to diagnostic evaluation by a qualified medical professional	Percentage of patients who left the ED before being seen
30-Day death and readmission rates	Hospital 30-day death (mortality) rates from heart attack	2725	−0.09	**−0.11**	−0.08	*−0.04*	0.08
	Hospital 30-day death (mortality) rates from heart failure	3979	**−0.20**	**−0.18**	**−0.15**	−0.05	−0.03
	Hospital 30-day death (mortality) rates from pneumonia	4279	−0.08	**−0.10**	−0.09	0.00	0.06
	Hospital 30-day readmission rates from heart attack	2375	**0.14**	**0.11**	0.04	0.05	0.01
	Hospital 30-day readmission rates from heart failure	4063	**0.14**	**0.11**	0.05	0.06	0.05
	Hospital 30-day readmission rates from pneumonia	4294	0.17	0.12	0.11	0.09	0.05
AMI	Timing of receipt of primary percutaneous coronary intervention	1416	−0.09	−0.04	−0.07	−0.12	−0.04
	Median time to ECG	2080	0.03	−0.02	0.02	0.08	0.07
	Median time to transfer	400	0.16	0.10	0.09	0.11	0.10
	Percent receiving aspirin at arrival	2051	0.02	0.06	−0.03	−0.10	−0.15
	Fibrinolytic therapy received within 30 min of hospital arrival (%)	109	−0.07	−0.05	0.00	0.05	−0.01
	Median time to fibrinolytic therapy	109	0.07	0.07	−0.01	−0.10	0.08
ED measures	Median time to pain medication for long bone fractures	2506	0.40	0.26	0.51	0.51	0.44
HCAHPS	Percentage of patients who reported that their nurses "always" communicated well	3569	−0.34	−0.33	−0.26	−0.11	−0.14
	Percentage of patients who reported that their doctors "always" communicated well	3569	−0.43	−0.41	−0.33	−0.13	−0.04
	Percentage of patients who reported that they "always" received help as soon as they wanted	3569	−0.45	−0.44	−0.37	−0.20	−0.16
	Percentage of patients who reported that their pain was "always" well controlled	3569	−0.26	−0.25	−0.21	−0.11	−0.09
	Percentage of patients who reported that staff "always" explained about medicines before giving it to them	3569	−0.31	−0.30	−0.24	−0.12	−0.07
	Percentage of patients who reported that their room and bathroom were "always" clean	3569	−0.38	−0.37	−0.32	−0.22	−0.20
	Percentage of patients who reported that the area around their room was "always" quiet at night	3569	−0.37	−0.35	−0.27	−0.12	0.05
	Percentage of patients at each hospital who reported that "yes" they were given information about what to do during recovery	3569	−0.23	−0.18	−0.13	−0.16	−0.23
	Percentage of patients who gave their hospital a rating of 9 or 10 on a	3569	−0.23	−0.17	−0.09	−0.11	−0.16

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Table 3 (*continued*)

Category	Description	No. reporting	Median time from ED arrival to ED departure for admitted ED patients	Admit decision time to ED departure time for admitted patients	Median time from ED arrival to ED departure for discharged ED patients	Door to diagnostic evaluation by a qualified medical professional	Percentage of patients who left the ED before being seen
	scale from 0 (lowest) to 10 (highest).						
	Percentage of patients who reported "yes" they would definitely recommend the hospital	3569	−0.05	0.00	0.07	−0.02	−0.14
HAC	Air embolism	3323	0.08	0.06	0.09	0.04	0.03
	CAUTI	3323	0.18	0.20	0.21	0.10	0.00
	CLABSI	3323	0.37	0.37	0.35	0.19	0.09
	Manifestations of poor glycemic control	3323	0.20	0.20	0.21	0.13	0.08
Medicare spending	Medicare spending per beneficiary	3256	0.22	0.24	0.17	0.09	0.08
Outpatient imaging efficiency	MRI lumbar spine for ow-back pain	1959	−0.24	−0.23	−0.17	−0.08	0.01
	Abdomen CT use of contrast material	3632	−0.11	−0.11	−0.09	−0.04	−0.08
	Thorax CT use of contrast material	3311	−0.09	−0.11	−0.09	−0.05	0.09
	Simultaneous use of brain CT and sinus CT	2173	0.05	0.03	0.07	0.06	0.10
ED pneumonia measures	Blood cultures performed in the ED before initial antibiotic received in hospital	3822	−0.11	−0.04	−0.08	−0.11	−0.08
	Initial antibiotic for community-acquired pneumonia in immunocompetent patient	3969	0.10	0.15	0.05	−0.06	−0.06
Serious complications and deaths (AHRQ measures)	Composite serious complications	2006	−0.09	−0.07	−0.04	−0.08	−0.09
	Iatrogenic pneumothorax	3304	−0.05	−0.06	−0.07	−0.03	−0.03
	Serious complications composite measure	3315	−0.04	−0.05	−0.03	−0.02	−0.02

Bold indicates effect size of at least "small" per Cohen's guidelines [15]; italics indicates correlation was not significant at $P < .05$ level.
Abbreviations: ECG, electrocardiogram; MRI, magnetic resonance imaging; CT, computed tomography.

availability of funds for quality improvement, or other factors. Future research should attempt to investigate these potential associations.

6. Conclusion

This study represents the first exploratory investigation of Hospital Compare's ED crowding metrics. We demonstrate considerable variation in reporting rates across hospital types and regional differences in reporting as well as variation in the measures themselves. Emergency department crowding was related to several measures of in-patient quality, which further suggests that ED crowding should be a hospital-wide priority for quality improvement efforts.

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